

Figure 1

U.S. Patent

Sep. 15, 1998

Sheet 2 of 23

5,809,431

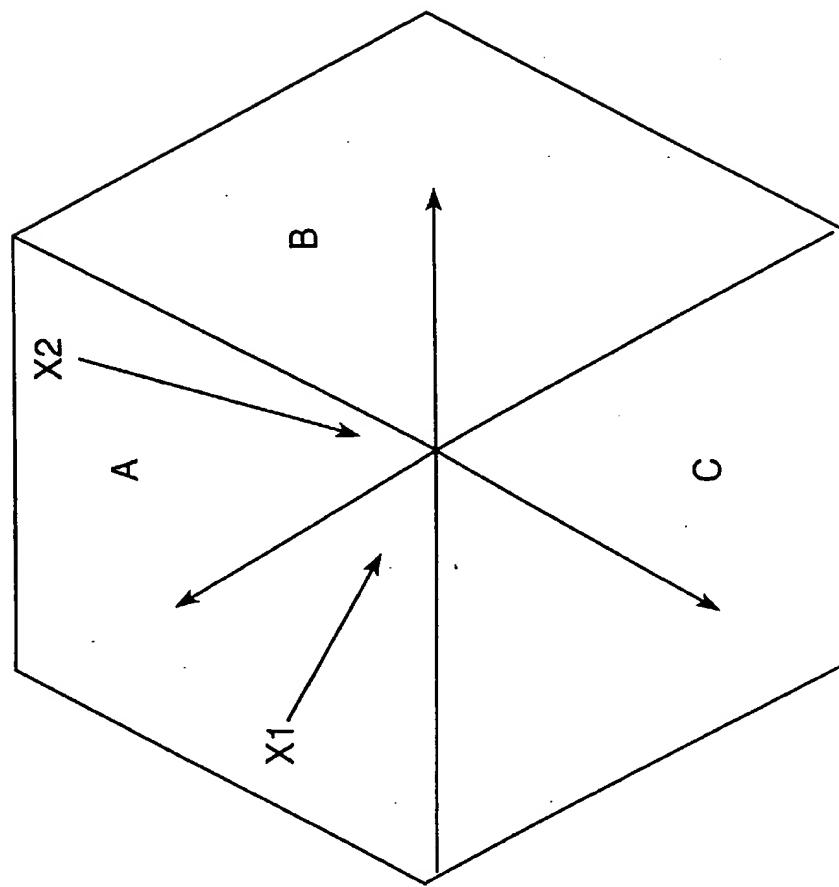


Figure 2

PARAMETER	VALUE
1. THREE, FOUR, SIX OR EIGHT SECTOR CELL DIVISION,& MORE CAN BE USED	120°, 90°, 60°, OR 45° COVERAGE PER SECTOR RESPECTIVELY
2. CELL DIMENSIONS	2 KM RADIUS, COMMUNICATION RANGE, 1 KM TYPICALLY WITHIN THE CELL, AND 1 KM BEYOND THE NORMAL CELL BOUNDARY
3. RAIN FADE	7 dB/KM, 14 dB TOTAL
4. FOLIAGE ATTENUATION	10 dB TO 20 dB ASSUMED PER TREE. OVERCOME BY USE OF BASE STATION DIVERSITY
5. REQUIRED HUB TO SUBSCRIBER C/(NO+1)	7 dB
6. REQUIRED SUBSCRIBER TO HUB C/(NO+1)	7 dB
7. HUB ANTENNA GAIN	13.5 dB, 15dB, 16.5dB, & 18dB FOR 120°, 90°, 60°, AND 45° COVERAGE, 3 dB BEAM WIDTHS RESPECTIVELY.
8. SUBSCRIBER ANTENNA GAIN	35 dB, 3.8 DEGREE, 3 dB BEAM WIDTH IN ALL CASES
9. HUB TRANSMIT POWER	1 W
10. SUBSCRIBER TRANSMIT POWER	100 mW TO 200 mW
11. DOWN STREAM DATA RATE	10 Mbps INITIALLY, 51 Mbps FUTURE REQUIREMENT
12. UP STREAM DATA RATE	T1 (1.024 Mbps) INITIALLY, 10Mbps TO 51 Mbps FUTURE REQUIREMENT
13. DOWN STREAM FREQUENCY BAND	27.5 GHz TO 28.35GHz, 850 MHz TOTAL
14. UP STREAM FREQUENCY BAND	29.1 GHz TO 29.25 GHz 150 MHz TOTAL
15. SUBSCRIBER POPULATION PER CELL OF 1 KM RADIUS	1000 TOTAL SUBSCRIBERS, 60% TO 85% TO BE SERVICED. POPULATION TO BE SERVICED CAN BE INCREASED BY INCREASED CELL SECTORIZATION AND THE USE OF POLARIZATION DIVERSITY.
16. FREQUENCY RE-USE	FREQUENCY RE-USE OF 1 ACHIEVABLE WITHOUT POLARIZATION DIVERSITY WHEN USING THE OPTIMAL CELL CONFIGURATION FOR BOTH RECTANGULAR AND HEXAGONAL ARRAYS. FREQUENCY RE-USE OF 1 ACHIEVABLE WHEN OPERATING IN A DISADVANTAGED CELL ARRAY THROUGH THE USE OF POLARIZATION DIVERSITY.
17. INTERFACE TO GEOGRAPHICALLY REMOTE CELLS	SATELLITE LINK BETWEEN HEAD END AND BASE STATION OF GEOGRAPHICALLY REMOTE CELLS CAN BE PROVIDED WITH A REDUCED REMOTE SYSTEM CAPACITY.

FIG . 3a

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PARAMETER	VALUE
DOWN STREAM LINK	
1) TOTAL BANDWIDTH ALLOCATED	850MHz
2) FREQUENCY RE-USE, SECTORS PER CELL	FREQUENCY RE-USE OF 1, 4 SECTORS/CELL
3) DATA FORMAT	CONTINUOUS CARRIER TDMA
4) NUMBER OF CARRIERS TOTAL & CARRIERS/SECTOR	24 CARRIERS TOTAL, 6 CARRIERS/SECTOR
5) CARRIER SPACING	1/T = F = TRANSMITTED DATA RATE OF THE CHANNEL
6) DATA RATE: PAYLOAD, TRANSMITTED	OC-1 (51.84 Mbps), 52.2 Mbps
7) DATA MODULATION	QPSK
8) DATA CODING	RATE 7/8 CONVOLUTIONAL ENCODING, INTERLEAVED, AND (60,54) REED SOLOMON CODING
9) TRANSMIT CELL DATA STRUCTURE	1 SYNC BYTE, 5 BYTE HEADER, 48 BYTE ATM PAYLOAD, 6 BYTE RS BITS
UP STREAM LINK	
1) TOTAL BANDWIDTH ALLOCATED	150 MHz
2) FREQUENCY RE-USE, SECTORS PER CELL	1 IN 4 FREQUENCY RE-USE, 4 SECTORS/CELL
3) DATA FORMAT	BURST CARRIER, BYTE SYNCHRONOUS TDMA
4) NUMBER OF CARRIERS TOTAL & CARRIERS/SECTOR	8 CARRIERS TOTAL, 2 CARRIERS/SECTOR
5) CARRIER SPACING	2/F' = 2F', WHERE F' = TRANSMITTED DATA RATE OF THE CHANNEL
6) DATA RATE	1/2 OC -1 (25.92 Mbps), 26.1 Mbps
7) DATA MODULATION	ALPHA = 0.25 ROOT-RAISED COSINE FILTERED QPSK
8) DATA CODING	(60,54) REED SOLOMON CODING
9) TRANSMIT CELL DATA STRUCTURE	1 SYNC BYTE, 5 BYTE HEADER, 48 BYTE ATM PAYLOAD, 6 BYTE RS BITS, FOLLOWED BY A 1 BYTE GUARD SPACE

FIG. 3b

FIG. 4b

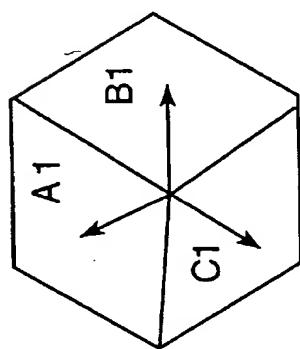
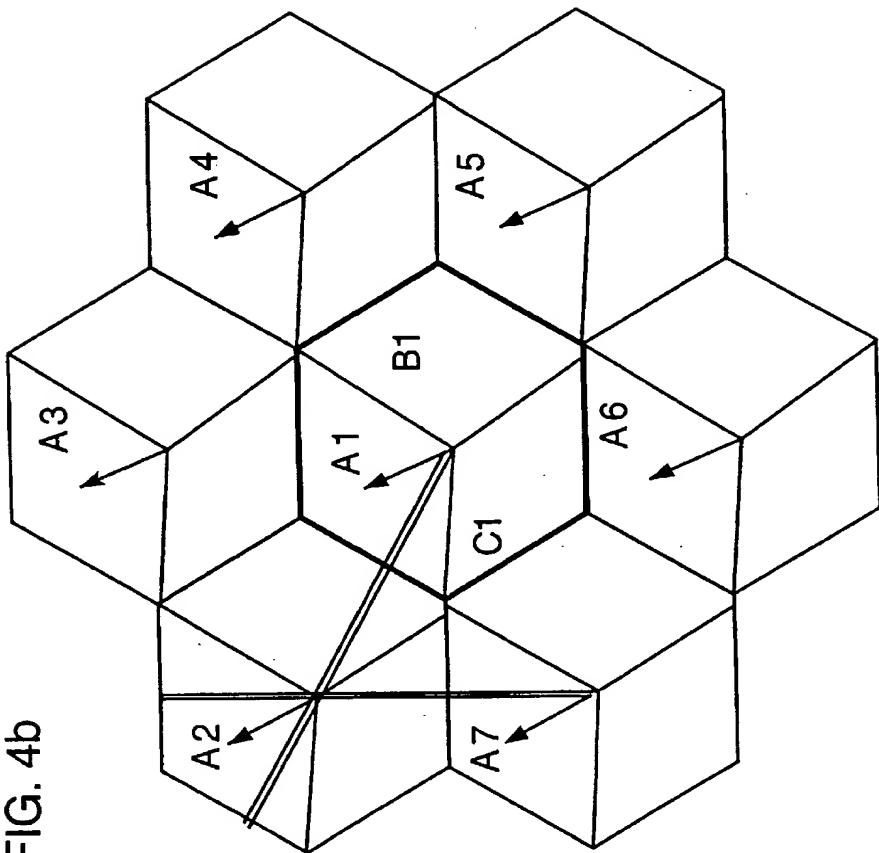
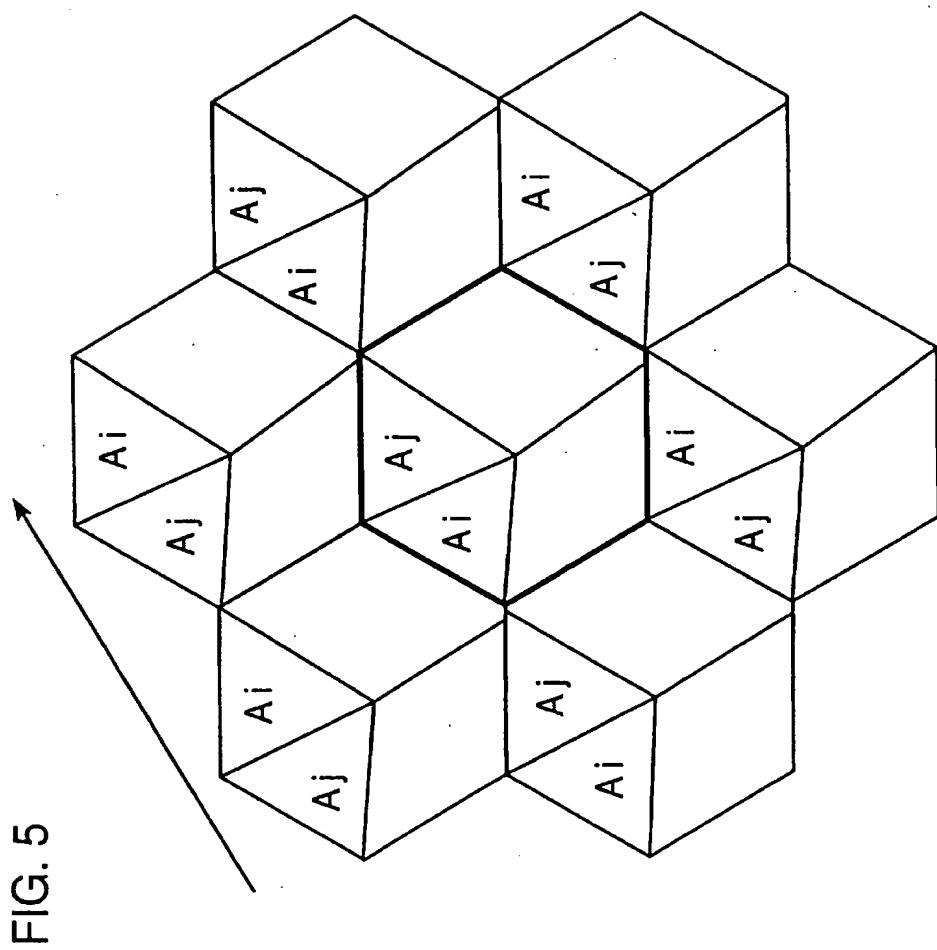


FIG. 4a



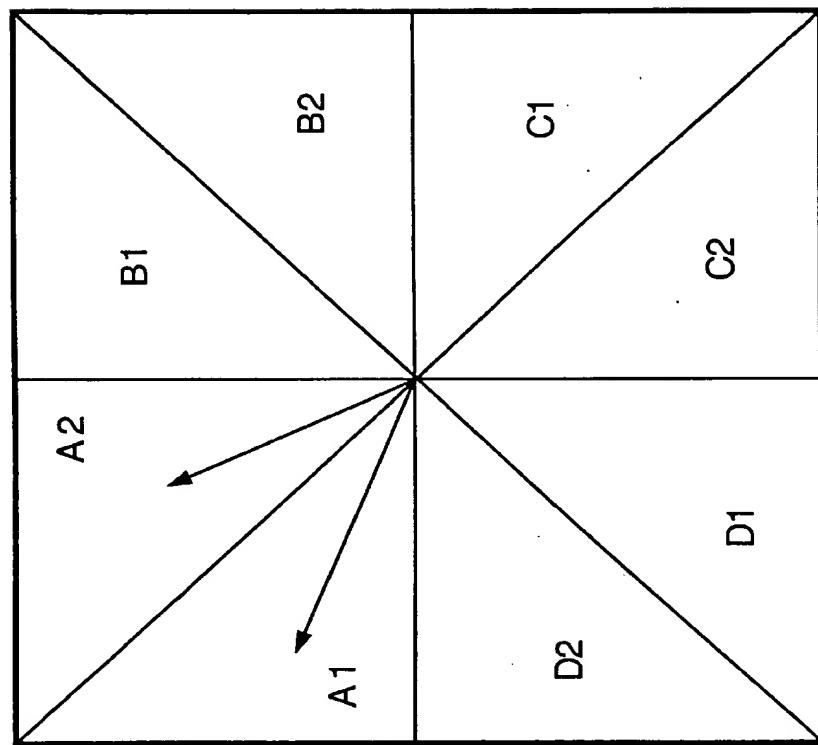


Figure 6a

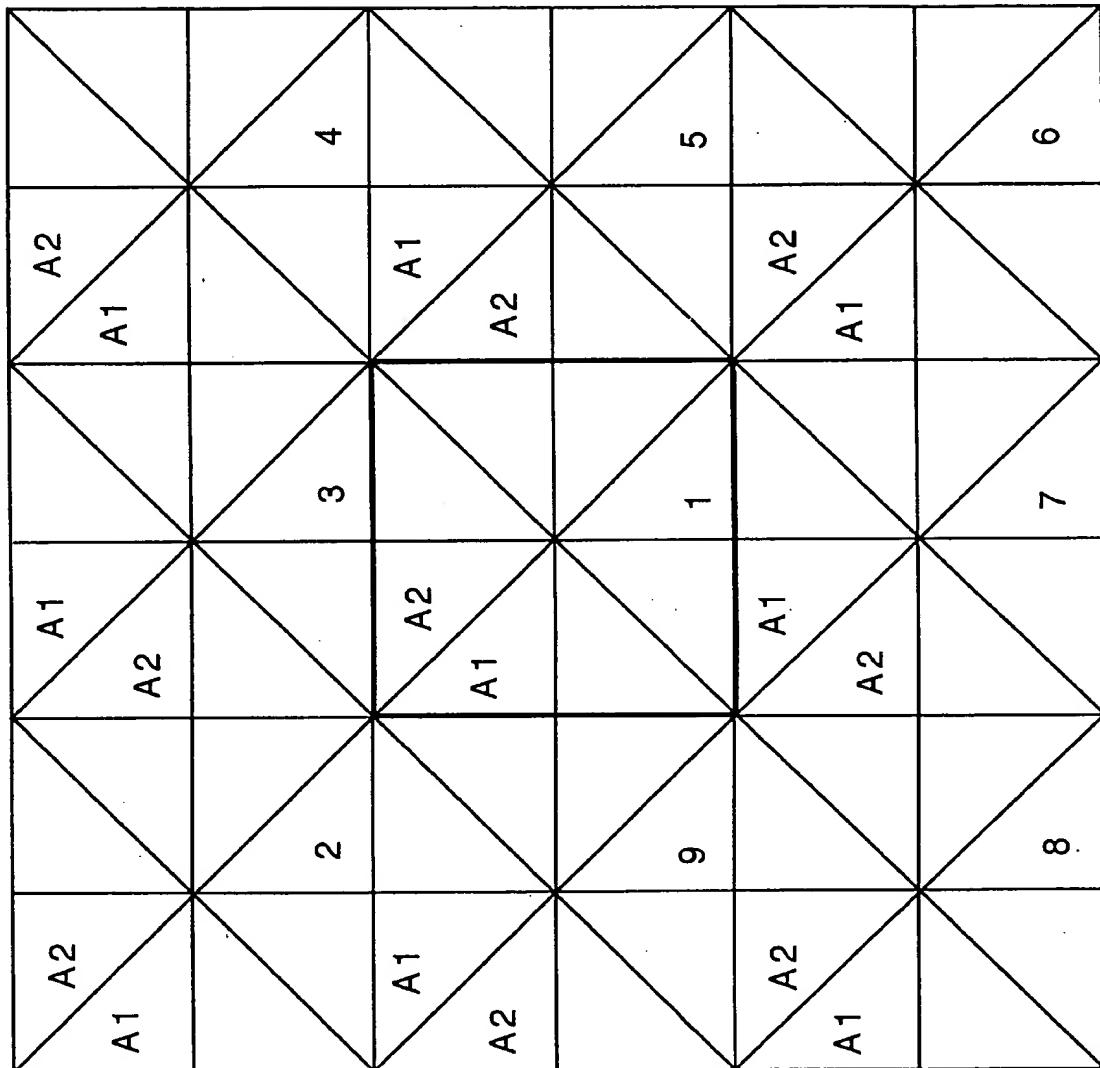


Figure 6b

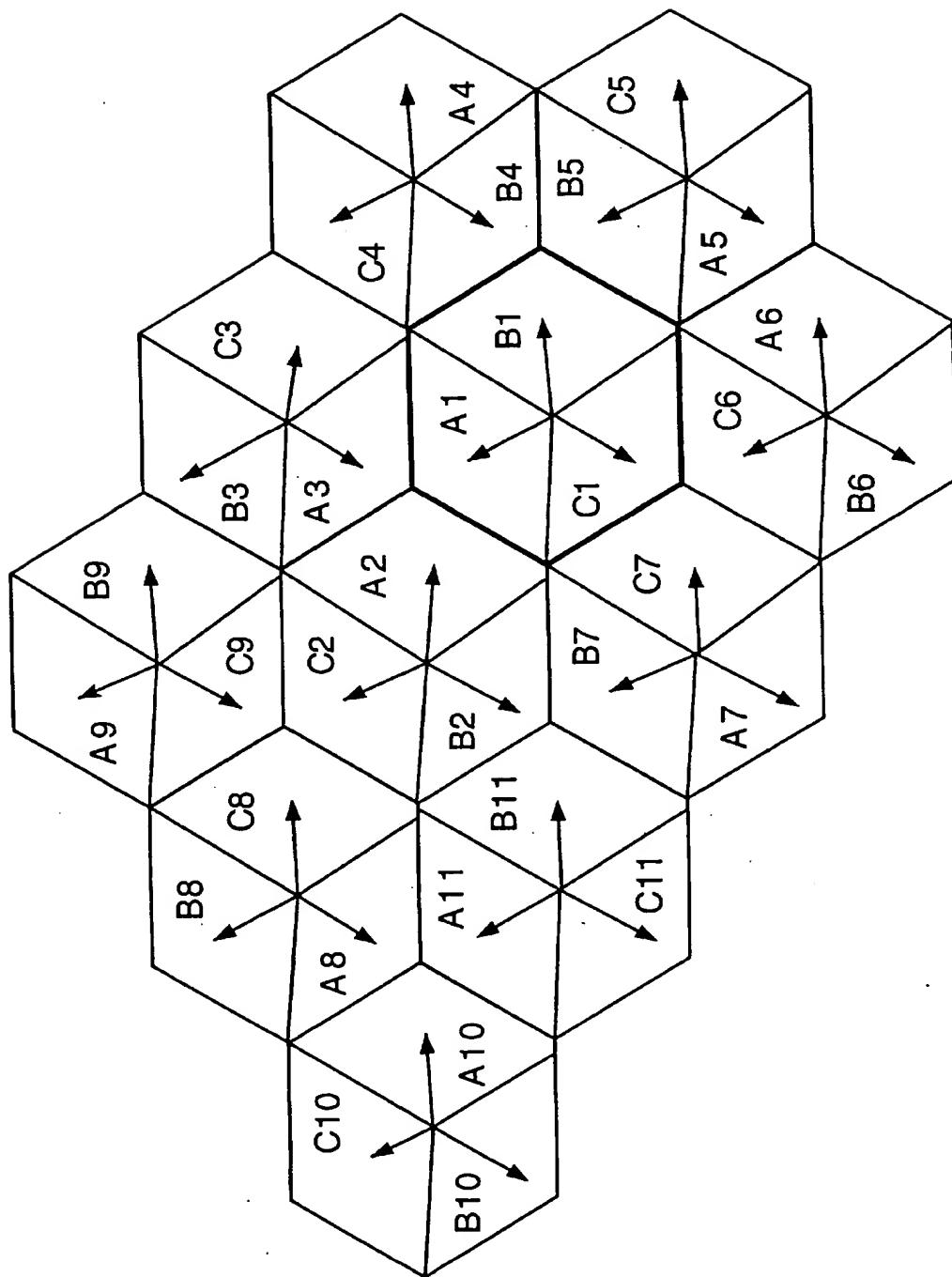
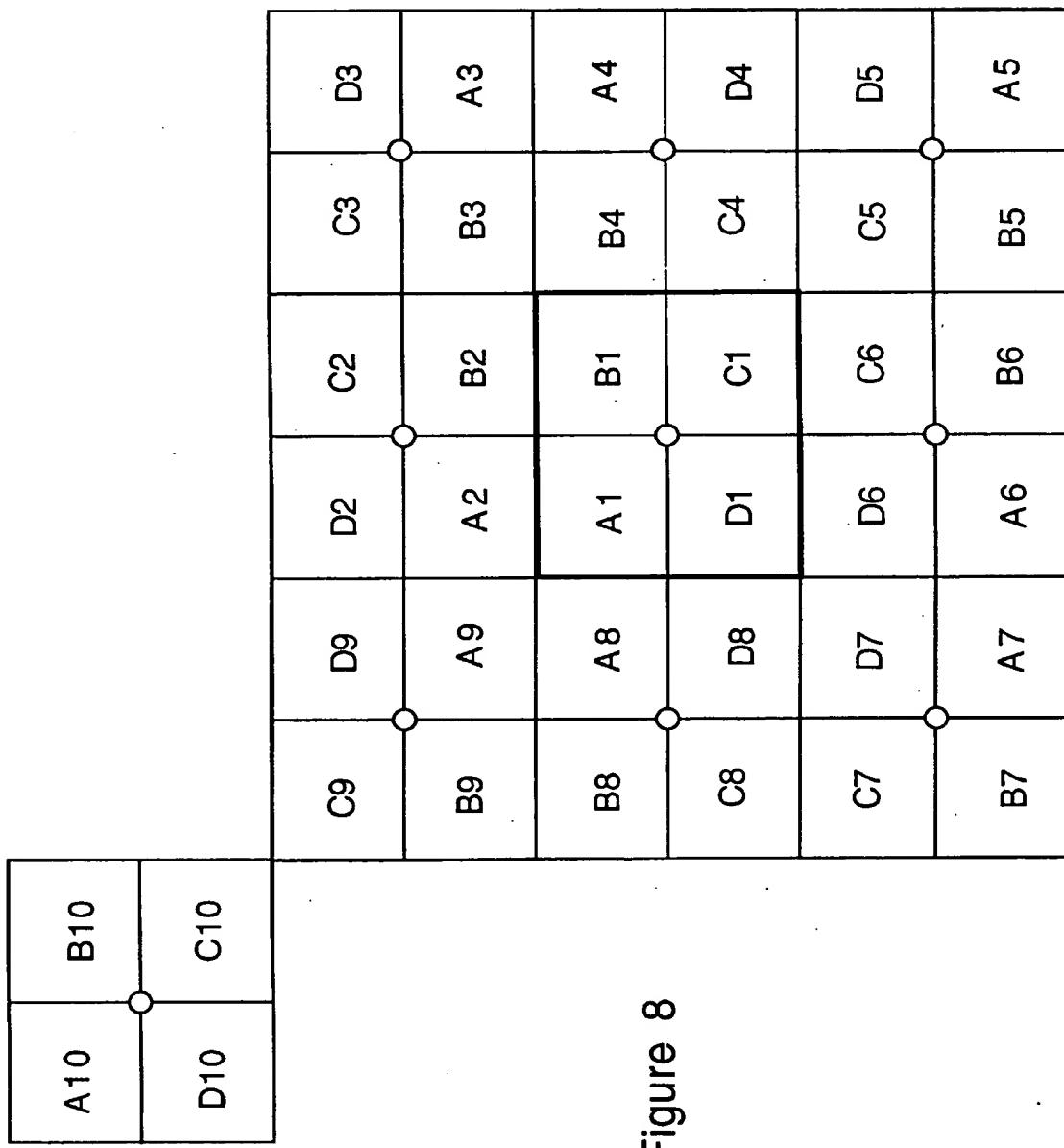


Figure 7



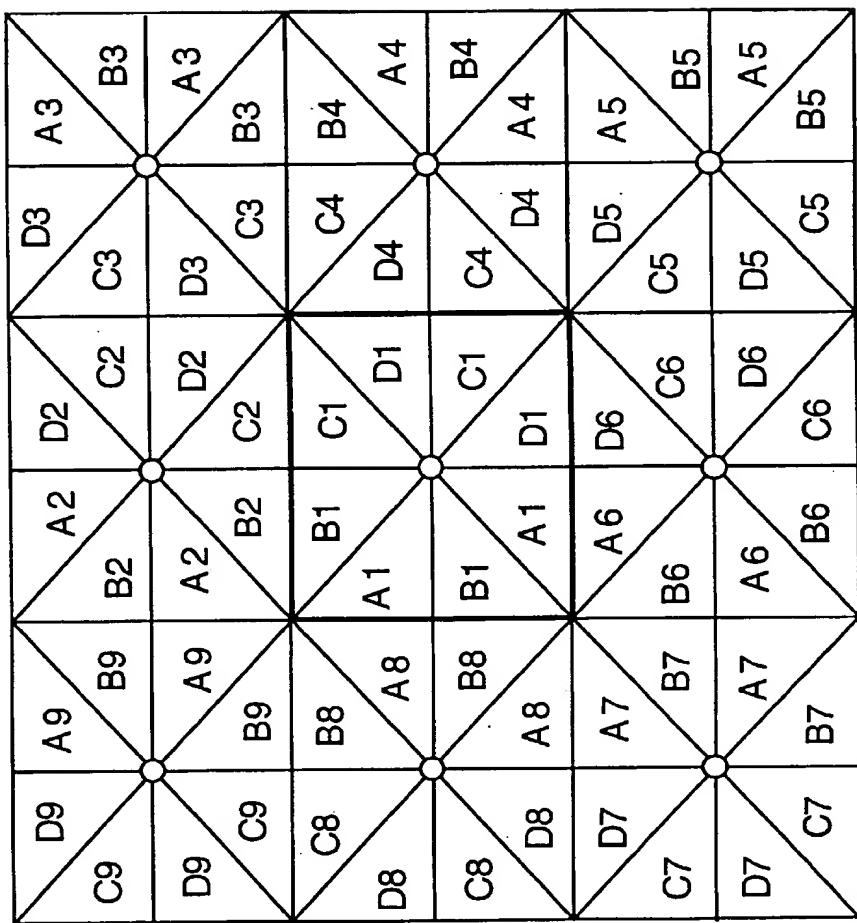
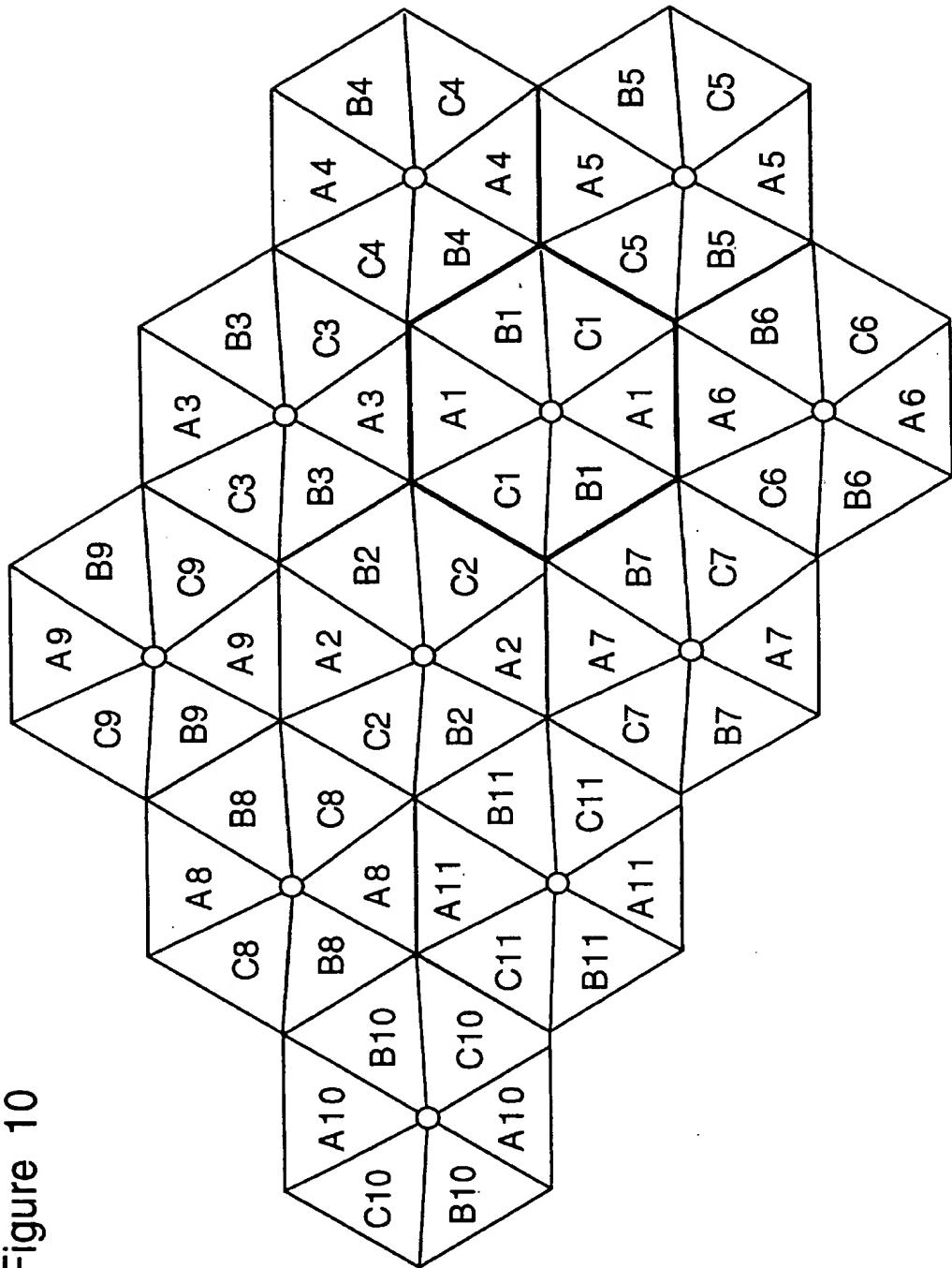
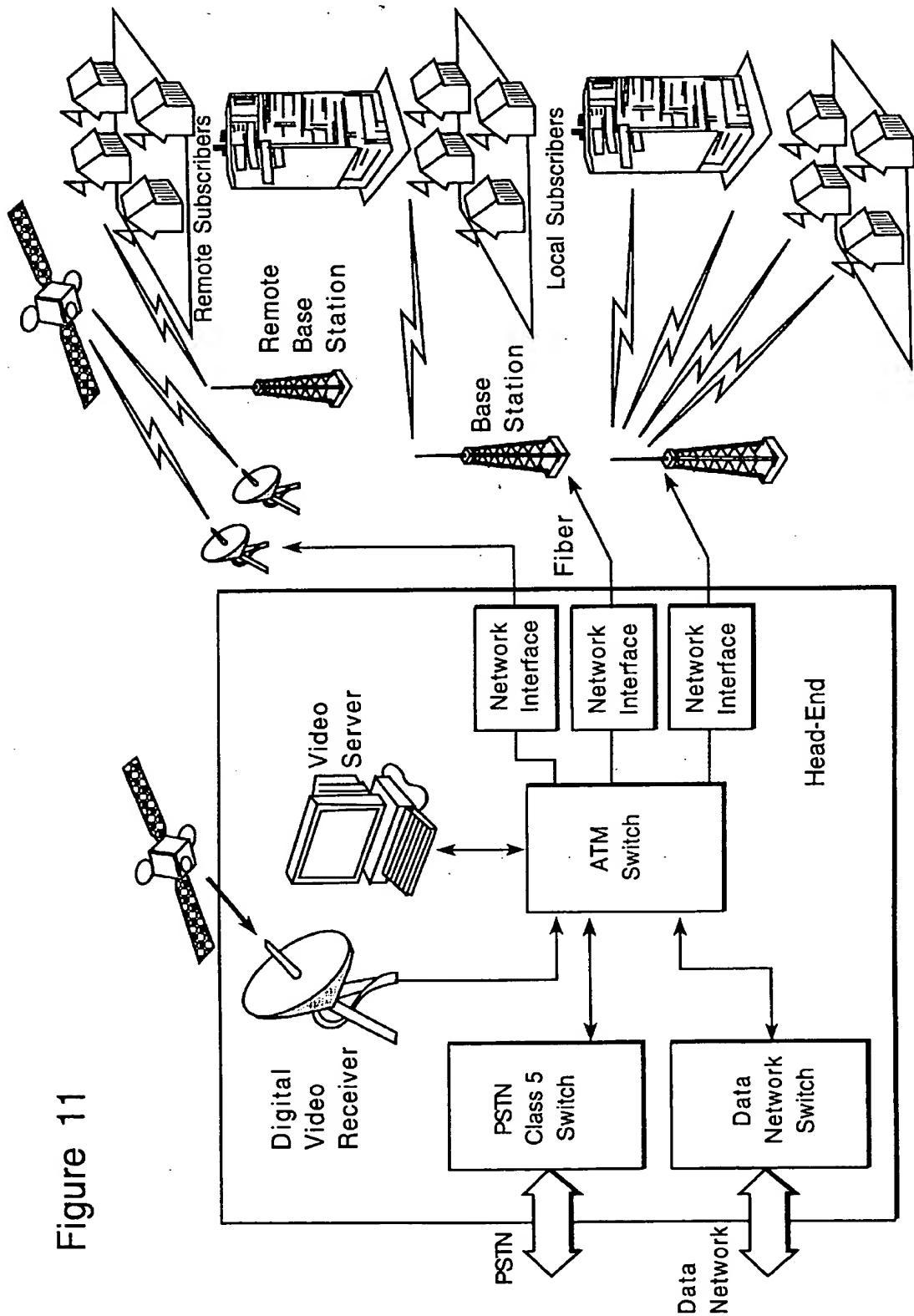


Figure 9

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Figure 10





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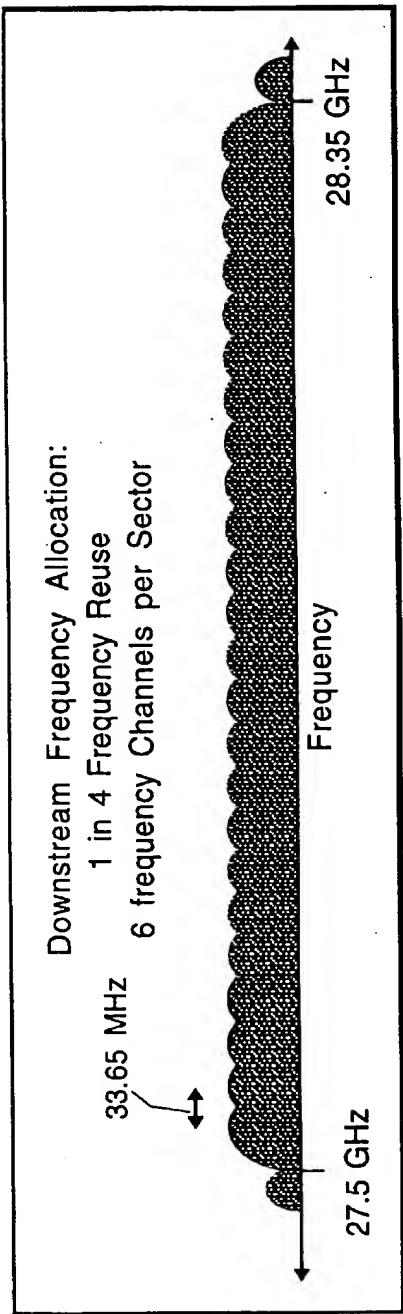


Figure 12a

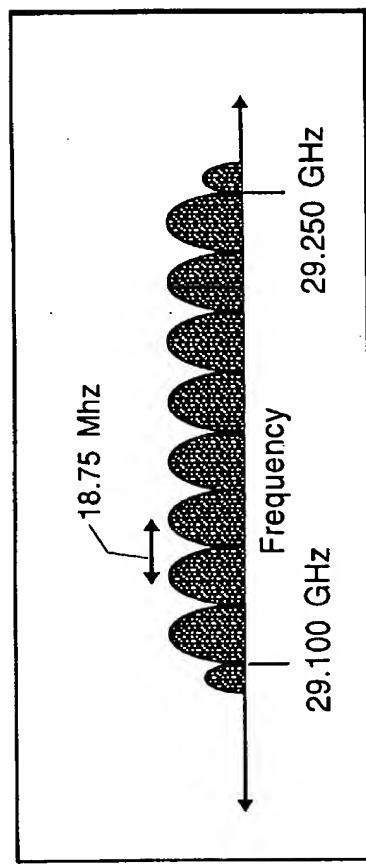
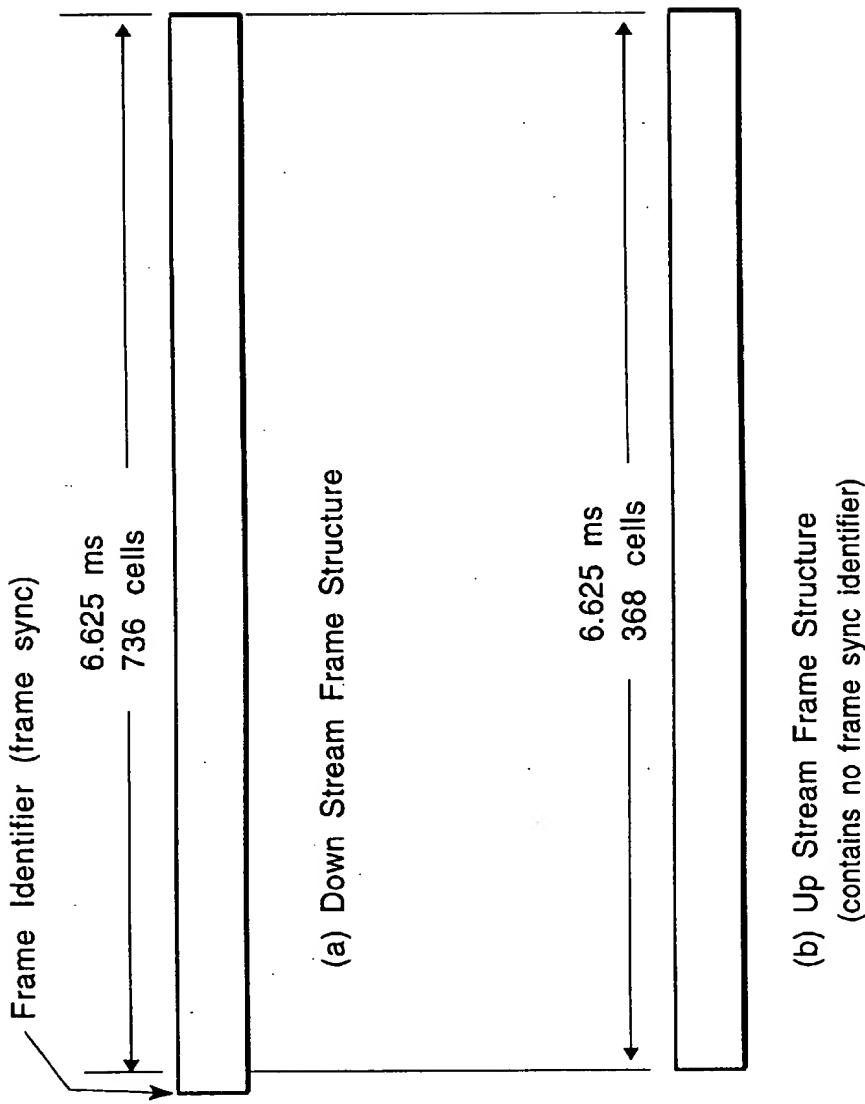
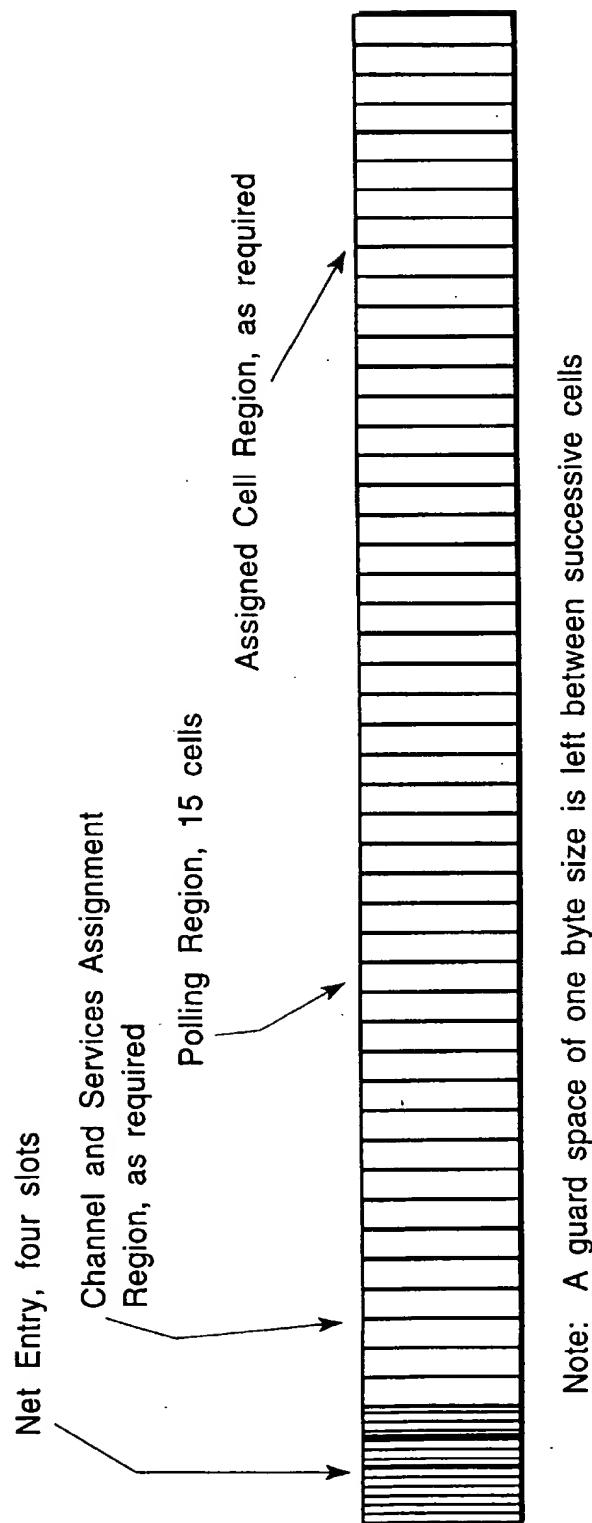


Figure 12b

Figure 13



Note: A guard space of one byte size is left between successive cells

Figure 14

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MESSAGE TYPE	SOURCE	DESTINATION	FUNCTION
INITIALIZATION REQUEST, FIGURE 14(a)	SUBSCRIBER	HEAD END	SUBSCRIBER ISSUES REQUEST FOR NET ENTRY FUNCTION TO BE INITIATED
INITIALIZATION RESPONSE, FIGURE 14 (d)	HEAD END	SUBSCRIBER	ISSUE INITIAL POWER, TIMING, AND FREQUENCY ADJUSTMENTS TO SUBSCRIBER, AND TRANSFER SUBSCRIBER OPERATIONS TO CHANNEL & SERVICES ASSIGNMENT REGION
TERMINATE REQUEST FIGURE 14 (a)	SUBSCRIBER	HEAD END	SUBSCRIBER ISSUES REQUEST FOR TERMINATION OF ONGOING SERVICES
TERMINATE COMMAND (a). FIGURE 14 (b)	HEAD END	SUBSCRIBER	HEAD END ISSUES COMMAND TO SUBSCRIBER TERMINATING ONGOING SERVICES AND ALL UP STREAM TRANSMISSIONS
TERMINATE COMMAND (b), FIGURE 14 (b)	HEAD END	SUBSCRIBER	HEAD END INDEPENDENTLY ISSUES COMMAND TO SUBSCRIBER TERMINATING ONGOING SERVICES AND ALL UP STREAM TRANSMISSIONS BECAUSE OF DEPICTED IMPROPER & REAL TIME UNCORRECTABLE SUBSCRIBER OPERATING CONDITIONS
SERVICE REQUEST, FIGURE 14 (c)	SUBSCRIBER	HEAD END	SUBSCRIBER IDENTIFICATION OF & REQUEST FOR INITIATION OF NEW SERVICES REQUIRED SERVICES
SERVICE REQUEST RESPONSE, FIGURE 14 (d) EXPANDED	HEAD END	SUBSCRIBER	CONTINUE REFINEMENT OF POWER, TIMING, AND FREQUENCY ADJUSTMENTS TO SUBSCRIBER, ISSUE DEFINITION OF SERVICES APPROVED FOR USE BY SUBSCRIBER AND TRANSFER SUBSCRIBER OPERATIONS TO ASSIGNED CELL REGION
STATUS REQUEST AND PARAMETER ADJUSTMENT COMMAND, FIGURE 14 (d)	HEAD END	SUBSCRIBER	HEAD END COMMAND TO SUBSCRIBER REQUESTING STATUS OF OPERATIONAL EQUIPMENT, & ALL IN-HOME MONITORING SERVICES, AND POWER, TIMING, & FREQUENCY ADJUSTMENT COMMANDS IF REQUIRED
REQUEST TO EXECUTE A FILE TRANSFER, FIGURE 14 (a) EXPANDED	SUBSCRIBER	HEAD END	THERE WILL BE TIMES THAT FILES OF DATA WILL BE TRANSFERRED FROM THE SUBSCRIBER TO THE HEAD END. THIS REQUEST DEFINES THE FILE DATA AND THE NEED TO INITIATE THIS OPERATION.
COMMAND TO PREPARE TO RECEIVE A DATA FILE. FIGURE 14 (b) EXPANDED	HEAD END	SUBSCRIBER	COMMAND TO SUBSCRIBER TO PREPARE FOR RECEPTION OF A DATA FILE, & DEFINITION OF HOW FILE WILL BE TRANSFERRED

FIG. 15

Figure 16a

6 bytes	6 bytes	2
Destination Address	Source Address	Message Type

Figure 16b

6 bytes	6 bytes	2	2
Destination Address	Source Address	Subscriber ID #	Message Type

Figure 16c

6 bytes	6 bytes	2	2	2	2
Destination Address	Source Address	Message Type	Service Type	Service Type	Service Type

Figure 16d

6 bytes	6 bytes	2	2	6
Destination Address	Source Address	Subscriber ID #	Message Type	Parameter Adjustments

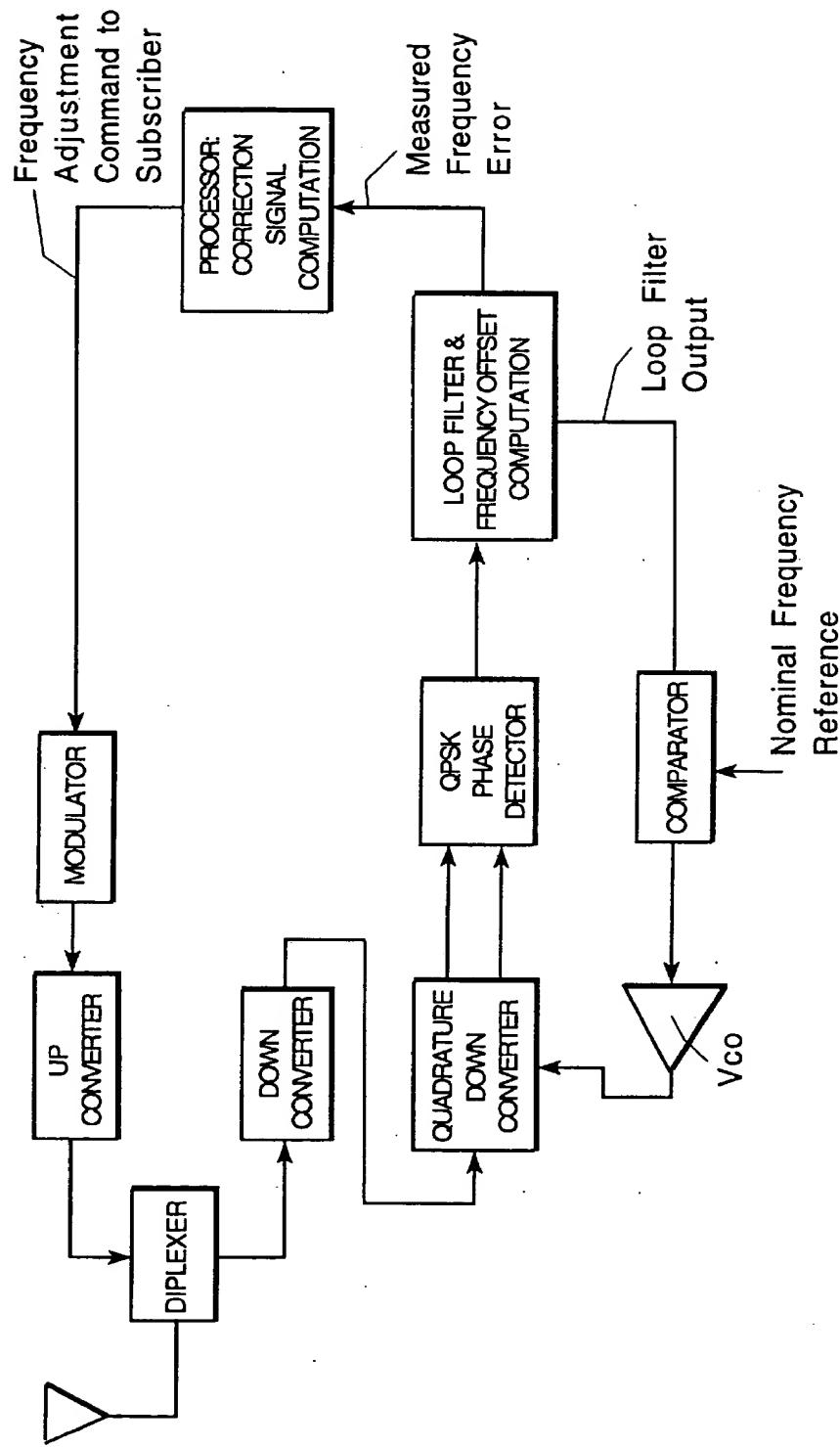


Figure 17

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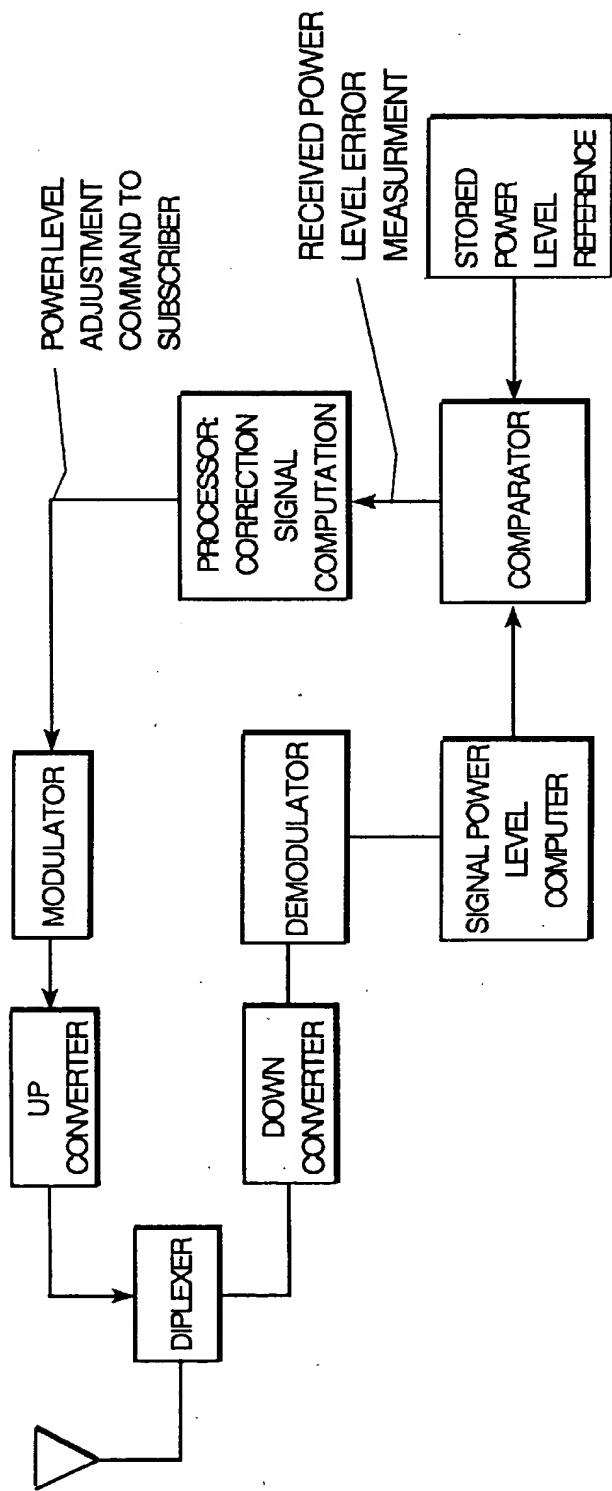


Figure 18

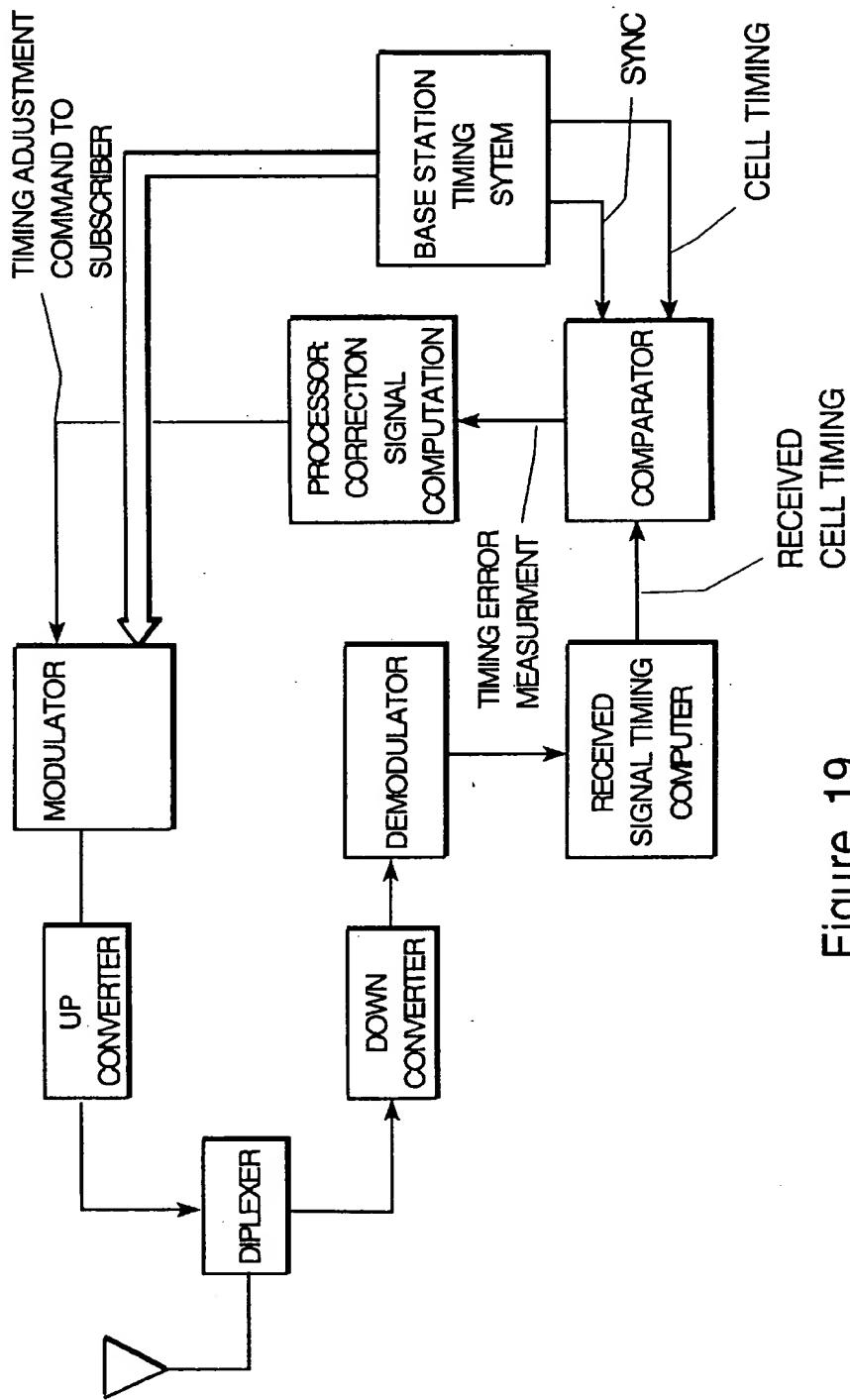
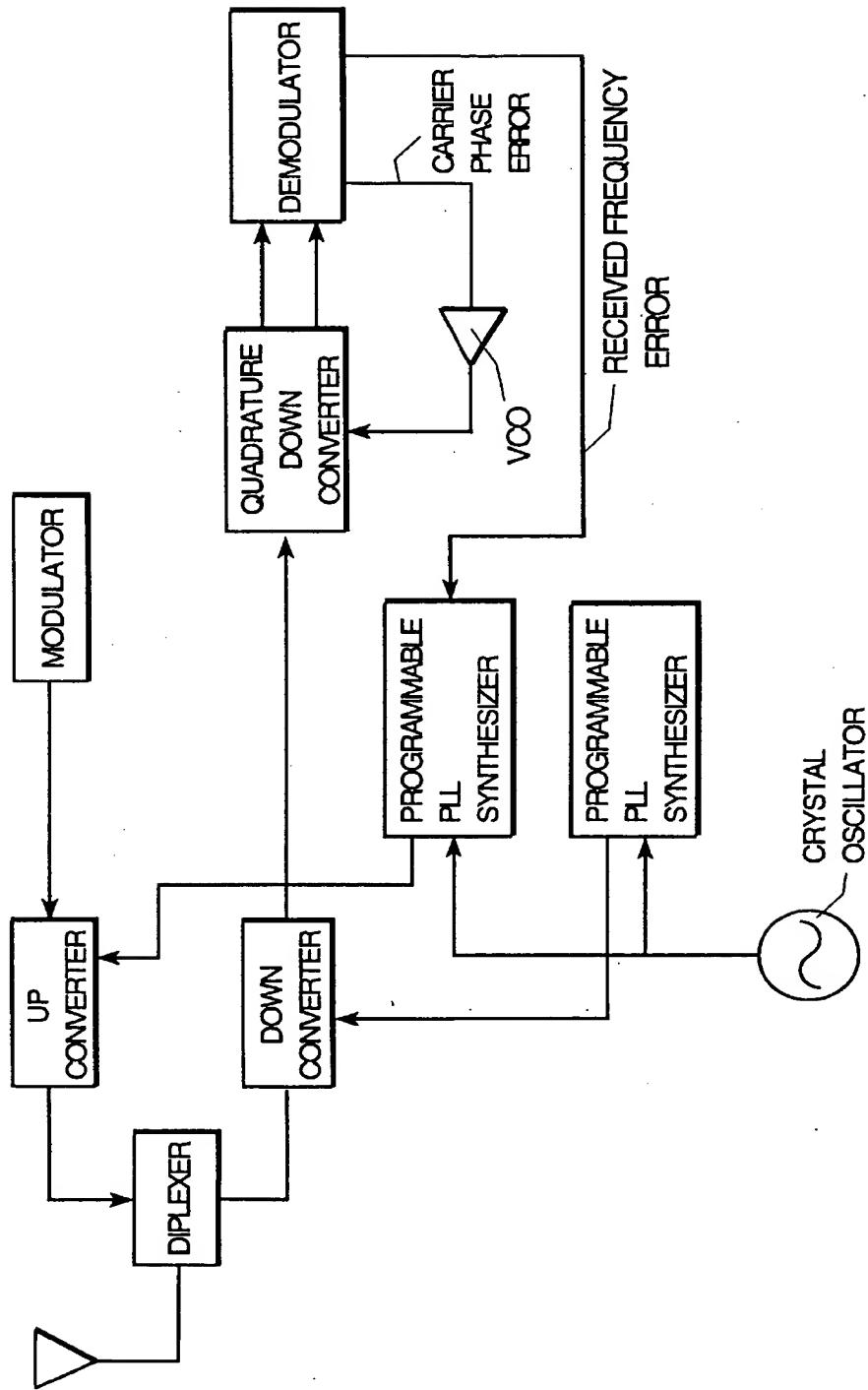


Figure 19

Figure 20



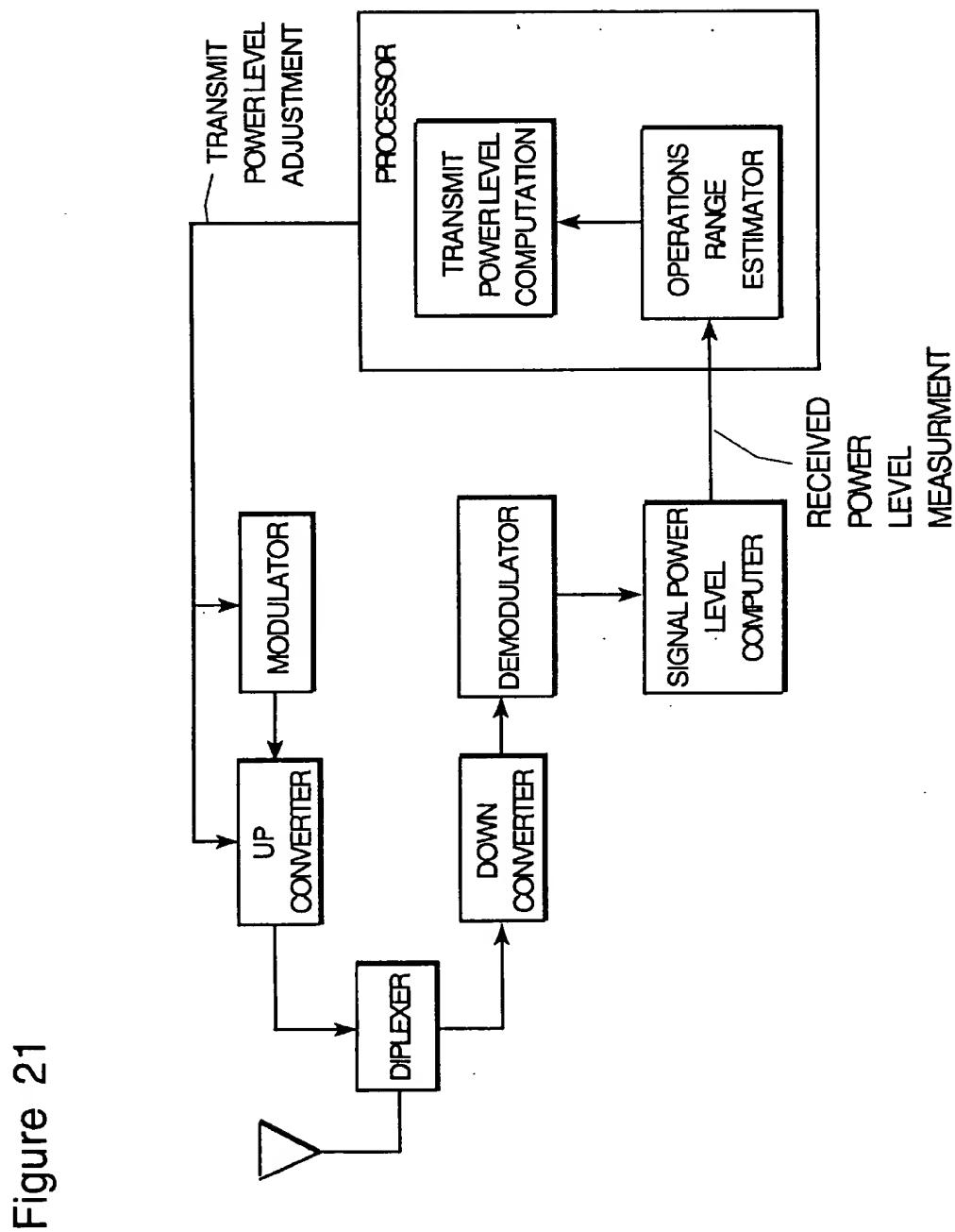


Figure 21